Name Date Class

LAB Wavelength, Frequency, and Wave Speed

LAB A

Background

Some waves travel through space; others pass through a medium such as air, water, or earth. Each wave has a wavelength, speed, frequency, and amplitude.

Question

How can the speed of a wave be measured? How can the wavelength be determined from the frequency?

Materials

long spring, rope, or hose
meterstick
stopwatch

Objectives

- **Measure** the speed of a transverse wave.
- **Create** waves with different frequencies.
- **Measure** the wavelength of a transverse wave.

Safety Precautions

Procedure

❑ 1. Read the procedure and safety information, and complete the lab form.

❑ 2. Make a copy of **Data Table 1**. With a partner, lay the long spring, rope, or hose across an open floor and measure its length. Record the length of the spring in **Data Table 1**. Make sure that the spring is stretched to the same length for each step.

❑ 3. Have your partner hold one end of the spring.
- ❑ Create a single wave pulse by shaking the other end of the spring back and forth.

❑ 4. Have a third person use a stopwatch to measure the time needed for the pulse to travel the length of the spring.
- ❑ Record this measurement in **Data Table 1**.

❑ 5. Repeat steps 3 and 4 two more times.

❑ 6. Calculate the speed of waves 1, 2, and 3 in **Data Table 1**. Average the speeds of waves 1, 2, and 3 to find the speed of waves on your spring.

❑ 7. Make a copy of **Data Table 2**.

❑ 8. Create a series of waves with the same wavelength. You make one wavelength when your hand moves left, right, and left again. Count the number of wavelengths that you generate in 10 s. Record this measurement for wave 4 in the column marked Waves in 10 s in **Data Table 2**.

❑ 9. Repeat step 8 two more times. Each time, create a wave with a different wavelength by shaking the spring faster or slower.

Data Table 1

	Length of Spring (m)	Time for Wave to Travel Spring Length (s)	Speed of Wave (m/s)
Wave 1			
Wave 2			
Wave 3			

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Data Table 2

	Waves in 10 s	Frequency (Hz)	Wavelength (m)
Wave 4			
Wave 5			
Wave 6			

Analyze Your Data

1. **Calculate** the frequency of waves 4, 5, and 6. Remember that frequency is the same as the number of waves that pass in one second.

2. **Calculate** Use the equation $v = f\lambda$ to find the wavelength of waves 4, 5, and 6. Use the average speed calculated in step 8 for the wave speed.

3. **Identify** the potential sources of error in this lab.

Conclude and Apply

1. **Compare** Were the three wave speeds that you calculated in step 6 significantly different from one another? Why or why not?

2. **Explain** why you would average the speeds of the three different pulses to calculate the speed of the waves on the spring.

3. **Describe** how the wavelength of the waves that you created depends on the frequency of the waves.

Communicate Your Data

Create Ask your teacher to set up a contest between the groups in your class. Have each group compete to determine who can create waves with the longest wavelength, the highest frequency, and the largest wave speed. Record the measurements of each group's efforts on the board.